DRAFT

SUPPLEMENTAL
SCALE SAMPLING AND ANALYSIS PLAN
TRANSITE PIPE REMOVAL ACTION

YERINGTON MINE SITE

APRIL 23, 2010

PREPARED FOR:

Atlantic Richfield Company
4 CENTERPOINTE DRIVE
LA PALMA, CALIFORNIA 90623

PREPARED BY:

Brown AND Caldwell

3264 Goni Rd, Suite 153
Carson City, Nevada 89706
(775) 883-4118

AND

FOXFIRE SCIENTIFIC INC

7105 Lake Mead Boulevard
Arlington, Texas 76016
(817) 563-0579

TABLE OF CONTENTS

SECTION **PAGE**

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

LIST OF ACRONYMS AND ABBREVIATIONS

AOC	Administrative Order on Consent
ARAR	Applicable, Relevant and Appropriate Requirements
ARC	Atlantic Richfield Company
EPA	Environmental Protection Agency
HAs	Homogeneous-Area
NAC	Nevada Administrative Code
NDEP	Nevada Division of Environmental Protection
NDHHS	Nevada Department of Health and Human Services
QAPP	Quality Assurance Project Plan
RAP	Removal Action Plan
RCA	Radiological Control Area
SAP	Supplemental Analysis Plan
Site	Yerington Mine Site
SOW	Scope of Work
TENORM	Technically-Enhanced Naturally Occurring Radioactive Materials
VLT	Vat Leach Tailings
UEP	Unlined Evaporation Pond
cm	centimeters
g	gram
pCi	picocurie

SECTION 1.0
INTRODUCTION

Atlantic Richfield Company (ARC) has prepared this Supplemental Scale Sampling and Analysis Plan (SAP) as a supplement to the Transite Pipe Removal Action Work Plan (Work Plan) - Revision 1) dated August 19, 2009 to support the removal of remnant transite (i.e., concrete and asbestos) pipe at the Yerington Mine Site (Site). Based on comments provided by the U.S. Environmental Protection Agency – Region 9 (EPA) on the Draft Transite Pipe Removal Action Plan (RAP) dated January 8, 2010, ARC, EPA, the Nevada Division of Environmental Protection (NDEP) and the Nevada Department of Health and Human Services (NDHHS) conducted a technical meeting and Site visit on April 8 and 13, respectively to discuss: 1) the approach to characterizing transite pipe with technically enhanced naturally occurring radioactive materials (TENORM); and 2) the elements of this draft SAP. The transite pipe removal action is required under the Administrative Order on Consent (AOC) and associated Scope of Work (SOW)[1] dated April 21, 2009 (effective May 1, 2009). Given that this SAP is a supplement to the Work Plan described above, it does not include the background information provided in the Work Plan.

The objective of this SAP is to provide additional field and laboratory data necessary to determine whether transite pipe with scale or sediment in long pipe runs exceeds the revised Site-specific applicable or relevant and appropriate requirement (ARAR) of 5 picoCuries per gram (pCi/g) of radium-226. This objective will be accomplished by a combination of gamma surveys and laboratory analysis of scale for radiochemical concentrations. The revised ARAR is based on Nevada Administrative Code (NAC) Section 459.184, which exempts TENORM containing less than 5 pCi/g of radium-226 from the provisions of NAC 459.180 to 459.314, inclusive. Off-Site disposal of transite pipe characterized as mixed asbestos-TENORM waste (i.e., above the revised Site-specific ARAR) will be required for pipe sections with scale concentrations above 5 pCi/g of radium-226.

[1] Administrative Order on Consent and Settlement Agreement for Past Response Costs Anaconda Copper Mine, Yerington Nevada; U.S. EPA Region IX; CERCLA Docket No. 09-2009-0010.

Pursuant to the NAC, point exceedances of 5 pCi/g of radium-226 are not a regulatory concern as long as the average concentrations of lengths of pipe used for the same purpose do not exceed 5 pCi/g of radium-226. The existing Homogeneous Areas (HAs) identified in the Work Plan and draft will be further sub-divided into long pipe runs used for the same purpose and individual pipe sections whose origin or original use is not known in a revised RAP. As a conservative measure, the long pipe runs will be determined to be less than the Site-specific ARAR only if all sample results are less than 5 pCi/g of radium-226. If any results are greater than 5 pCi/g of radium-226, then the pipe sections will be evaluated on a piece by piece basis.

SECTION 2.0
SURVEYING AND SAMPLING PLAN

Upon EPA approval of this SAP, ARC will implement a radiochemical inspection and characterization (i.e., sampling and analysis) program to identify, quantify and classify transite pipe and associated materials that occur on the Site. As described above, pursuant to the NAC, point exceedances of 5 pCi/g of radium-226 are not a regulatory concern as long as the average concentrations of lengths of pipe used for the same purpose do not exceed 5 pCi/g of radium-226. Figures 2-1 and 2-2 depict the identified long pipe runs and other areas which contain disconnected pipes whose original location or use is not known. Within each long pipe run, locations at which to take surveys and samples were identified based on best professional judgment. These locations were selected based on observed occurrences of scale and at topographic low points where scale formation or sediment settling is more likely. Figures 2-1 and 2-2 also depict the locations selected for radiometric surveys and the collection of samples for radiometric analysis. Photographs of each location are provided in Appendix A.

2.1 Survey and Sample Locations

Subsequent to the April 13, 2010 Site visit, Brown and Caldwell (ARC's contractor) conducted a comprehensive inspection of the HAs to identify potential locations for interior scale samples and associated radiometric surveys. The following 25 locations, including re-sampling of scale in HA-1 and HA-4 (HA-4 contains the radiological control area or RCA) were identified and spray-painted based on observed occurrences of scale or sediment in open pipe sections or the potential for scale or sediment to accumulate in continuous pipe runs in topographically low sections:

<u>HA-1 (Used and new pipe laydown yard)</u>

HA-1-S1 – Observed fine grained white sediment in open end of single pipe length stockpiled in laydown area. Sediment is ~3-5 cm thick in the bottom portion of the pipe and <0.25 cm thick scale around the rest of the pipe interior. Lined pipe ~14" diameter.

HA-1-S2 – Interior portion of unlined transite pipe that appears rough and scale-like inside pipe, looks more like potentially impregnated asbestos pipe material rather than actual scale or sediment.

HA-1-S3 – Yellow scale coating on full interior surface of 12" lined pipe, coating is <0.25 cm thick. Yellow discoloration also occurs on the outside of pipe similar to what has been observed in the evaporation pond areas of the mine site.

HA-1-S4 – Two foot long section of unlined transite pipe attached to steel connector. A 2 cm thick accumulation of fine grained white/grey sediment was observed in the bottom of the pipe with little to no scale around the rest of the interior.

HA-1-S5 – Flaking interior of unlined transite pipe section that appears to be primarily degraded pipe material with potentially some whitish scale around entire pipe interior.

HA-1-S6 – A re-sample of the previously tested HA-1-07 location. White chalky scale coating entire pipe interior of lined transite pipe, ~0.5 cm thick.

<u>HA-2 (Mostly continuous pipe runs around W-2 dump leach area)</u>

HA-2-S7 – Open end of unlined 14" transite pipe with minor scale (<0.1 cm) and reddish discoloration of pipe interior. Located at southern end of dump leach pipe run where pipe was broken and moved for road access.

HA-2-S8 – Low section in dip along continuous pipe run with 2 parallel lines. Pipe will be dis-articulated to survey and possible sample collection.

HA-2-S9 – Low section in dip along continuous pipe run with 2 parallel lines. Pipe will be dis-articulated to survey and possible sample collection. Open end of pipe ~50 feet southeast does not show any scale material.

HA2-S10 – Low section in dip along continuous pipe run with 2 parallel lines. Pipe will be dis-articulated to survey and possible sample collection. Location is next to pipe drain outlets.

HA-2-S11 – Open end of lined pipe at top of hill. There is a build-up of what appears to be swollen pipe material at the joint where ore beneficiation solutions impregnated into pipe.

HA-2-S12 – Low section in dip along continuous pipe run with 2 parallel lines located on north side of Burch Drive. Pipe will be dis-articulated to survey and possible sample collection. Location is next to pipe drain outlets.

<u>HA-3 (Process Areas - east side)</u>

HA-3-S13 – Open section of 8" diameter lined transite pipe that was likely used for discharge of sulfide plant waste water to the sulfide tailings. A thin ribbon of loose white sediment, ~2 cm thick, was observed along bottom of pipe, no other scale observed on pipe interior.

HA-3-S14 – Open end of continuous pipe run located near the dump leach surge pond. Pipe was likely used for transport of dump leach solution from W-2 dump leach to the surge pond. Buildup of white flaky sediment at pipe joint that appears to be potentially impregnated asbestos pipe material eroded from other parts of the pipe.

HA-3-S15 – Flat section of continuous pipe from same pipe run as previous sample location. Interior of pipe is not visible but nearby joint shows deterioration and possible impregnation with leach solution.

HA-4 (Process Areas RCA and Iron Launders)

HA-4-S16 – Open end of pipe length that appears to have been disturbed from pipe run parallel to iron launders that may have carried pregnant solution to the iron launders. A thin white chalky scale is observed in portions of the pipe interior with loose white flakey material along bottom of pipe that may be similar scale knocked loose from other parts of the pipe. Pipe scale is <0.1 cm thick.

HA-4-S17 – Open end of pipe located in concrete trench box adjacent to RCA, pipe has demonstrated high radiological readings during previous investigations. Pipe interior appears highly degraded by solutions.

HA-4-S18 – Open end of south end of pipe run adjacent to iron launder. Pipe interior appears to be unlined or moderately degraded pipe material possibly with some thin (<0.1 cm) scale or sediment coating on pipe wall. There is sediment in bottom of pipe but it appears to be mixed gravel/VLT material that likely washed in after pipe was taken out of service (VLT will not be included in the scale sample).

HA-4-S19 – A re-sample of the previously tested HA-4-02 location, with a thin red scale coating on interior wall of transite pipe.

HA-4-S20 – A re-sample of the previously tested HA-4-01 location. Highly degraded and impregnated pipe material with some possible scale coating on pipe wall.

HA-5 (South sulfide tailings and southeast oxide tailings/calcine ditch locations)

HA-5-S21 – Continuous length of 8" transite pipe on top of sulfide tails located in a low area. Pipe will be dis-articulated to survey and possible sample collection.

HA-5-S25 – Wrapped steel pipe located in calcine ditch area that is half-full of yellow/beige fine grained sandy sediment. This pipe may have transported waste water from the iron launder or other portion of the plant to the unlined evaporation pond.

HA-5-S26 – Same pipe run as previous location. Wrapped steel pipe located in calcine ditch area that is half-full of yellow/beige fine grained sandy sediment.

HA-6 (North sulfide tailings area)

HA-6-S22 – Single length of pipe that has ~3-5 cm of yellow sandy sediment on bottom of pipe, sediment appears to be sulfide tailings material or evaporation pond sediment. Unable to tell origin or use of pipe.

HA-7 (Unlined Evaporation Pond)

HA-7-S23 – Large diameter (~20") transite pipe appears to have been an overflow outlet for the UEP. The pipe interior and exterior is coated with reddish/yellow scale and/or sediment ~0.5 cm thick.

HA-7-S24 – Same location and origin as previous sample from different length of pipe.

These supplemental scale samples will be subject to the gamma survey and radiochemical analyses described in Section 2.2.

2.2 Gamma Surveys and Sample Collection

As described above, select locations at topographically low sections of long pipe runs will be disarticulated and visually examined for any occurrence of scale or pipe wall impacted by ore beneficiation solutions. The portion of the pipe interior with the largest scale accumulation or thickest portion of impacted pipe wall, if present, will be selected for sample collection. If there is no observed scale or impacted pipe wall, then a sample will not be collected. However a gamma survey will still be performed at that location.

A gamma survey will be performed at each of the location listed above. The gamma survey probe will be positioned inside the pipe interior adjoining the location selected for the sample collection if a sample is to be collected. If no sample is to be collected, then the survey measurement will be taken on the bottom portion of the interior pipe wall. The survey measurements will be made with a Ludlum Model 44-2 NaI probe connected to a Ludlum Model 2241 series meter. The meter will be calibrated in units of counts per minute or otherwise configured to take a 30 second count. A jig will be attached to the probe to facilitate a consistent source-to-detector geometry such that the jig is positioned in contact with the pipe at the chosen location to maintain a constant separation distance of approximately 1 cm between the pipe wall and the probe. The probe will be held with the centerline of the probe parallel to the centerline of the pipe. A 30-second count will be taken at each location and recorded.

Near each surveying location, local comparison 30-second counts will be performed in the vicinity of the pipe to evaluate the impact of local variations in gamma radiation count rates upon the values measured inside the pipe sections. The locations at which to make the local comparison value counts will be determined in the field based upon the best professional judgment of the health physicist(s) in attendance.

Scale samples for radiochemical analyses will be collected at the selected locations where scale or transite pipe wall impacted by ore beneficiation solutions can be identified. Samples will be collected in a manner suitable for determining the radiochemical concentrations in the impacted portion of the interior pipe wall. Determination of the impacted portion of the interior pipe wall will be made based upon best professional judgment during the sample collection. Samples collected may include:

- Samples of pure scale, especially in lined pipes;
- Scale mixed with portions of pipe wall that cannot be readily separated (i.e., degraded pipe wall which is presumed to have been impacted by ore beneficiation solutions); and
- Interior pipe wall which has been degraded, presumably by ore beneficiation solutions.

Sample Analysis

Samples collected for radiochemical analyses will be analyzed for Ra-226, Ra-228, uranium, and thorium by the analytical methods identified in Table 2-2. The uranium and thorium concentrations may be based on the concentration of decay products with which they can be presumed to be in equilibrium. Samples will be submitted to Eberline Services (Oak Ridge, TN) for radiochemical analyses. Sample preparation, laboratory procedures and reporting limits will be consistent with the Quality Assurance Project Plan (QAPP, Revision 5; Environmental Standards, Inc. and Brown and Caldwell, 2009) for the Site to the extent practicable. Eberline Services is not part of the BP Global Lab Contractor Network (see Appendix C of the QAPP), but has been selected for this SAP due to their capability to prepare (grind and homogenize) and analyze radiochemical samples containing asbestos.

Table 2-1. Radiochemical Sample Analysis

Analyte	Analytical Method	Reporting Units	Reporting Limit
Ra-226	EPA 901.1 Mod/HASL 300	pCi/g	1.0 pCi/g
Ra-228	EPA 901.1 Mod/HASL 300	pCi/g	1.0 pCi/g
Uranium, Total	EPA 901.1 Mod/HASL 300	pCi/g	1.0 pCi/g
Thorium, Total	EPA 901.1 Mod/HASL 300	pCi/g	1.0 pCi/g

SECTION 3.0
DATA EVALUATION AND UPDATE OF REMOVAL ACTION PLAN

Upon completion of the surveying and receipt of the laboratory analytical results, the analytical and survey results will be statistically evaluated, with the objective of determining a gamma survey action level that can be used to reliably determine those pipe sections that contain scale or impacted portions of the interior pipe wall with less than 5 pCi/g of radium-226. Depending on the radiometric survey and laboratory analytical results, this action level may be determined by mathematical correlation of radium-226 concentrations with gamma count rate, by determination of an upper confidence limit associated with samples containing less than 5 pCi/g of radium-226, or by other quantitative method to be agreed upon by ARC and EPA.

Based on the results of the field and laboratory results obtained from implementing this SAP, the draft RAP dated January 8, 2010 will be revised to replace the previous radiochemical concentrations evaluation based upon bulk concentrations of transite pipe samples. ARC anticipates the revised RAP will be submitted to EPA on or before July 9, 2010. The pipe disposal decision tree contained in Figure 4-8 of the RAP will be replaced with the decision tree presented as Figure 3-1 of this SAP. The decision tree steps will be used prior to, and during, the implementation of the removal action. Only isolated pipe sections and pipe runs identified to contain scale samples greater than 5 pCi/g of radium-226 will require field gamma surveys during the removal action to determine if the pipe will be sent off-Site for disposal. Pipe sections whose internal pipe gamma survey results indicate that they contain scale or sediment less than the revised Site-specific ARAR will be marked for disposal in the on-Site landfill. The pipe sections with gamma survey results above the Site-specific ARAR will be set aside for temporary storage for further characterization and/or preparation for off-Site disposal.

SECTION 4.0

REFERENCES

Environmental Standards, Inc. and Brown and Caldwell, 2009. *Quality Assurance Project Plan, Yerington Mine Site, Revision 5*. Prepared for Atlantic Richfield Company. May 20.